Davis, N. G.

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THE

AMERICAN METHOD

OF

TREATING JOINT DISEASES AND DEFORMITIES.

BY

HENRY G. DAVIS, M. D.,
NEW YORK.

This then is the mode of cure, and it neither requires cutting, burning, or any other complex means.—HIPPOCRATES, *Sydenham Society's Translation*, vol. i. p. 632.

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THE AMERICAN METHOD OF TREATING JOINT DISEASES AND DEFORMITIES.

THE proper means of applying "CONTINUED ELASTIC EXTENSION" constitutes a most important—and, in many cases, the only needful—remedial measure for the treatment of joint diseases and deformities.

Development of the Treatment.—On the 27th of July, 1837, I began the treatment of my first case of disease of the spine. During its course, the conviction pressed itself upon me that contact, friction, or pressure of the diseased articulating surfaces plays an important rôle in the progressive destruction. Being naturally of a mechanical turn of mind, I set to work to devise such mechanical support for the diseased structures as would separate them from, or at least obviate pressure upon each other. The success that soon attended my efforts encouraged me. I found that I must overcome the contraction of the muscles of the trunk, and that this could best be done by a certain amount of counteracting extension, unremittingly exerted, as by means of some elastic material or its equivalent. To the force thus evolved I gave the descriptive name, "*continued elastic extension*," to distinguish it from the radically different uncontinued, inelastic power that is ordinarily called "extension" in surgery. As my opportunities for observation increased, I adapted apparatus, involving the same principles, to deformities and acute as well as chronic diseases *not* spinal. I first applied continued elastic extension to club-feet, then to bow-legs and wryneck; and in the course of some years extended the treatment thus methodized to old and otherwise irreducible dislocations, fractures, wounds, and injuries about joints; and finally, about the year 1848 or '9, to disease of the hip joint, until I gradually established to my own satisfaction the truth of the proposition that forms the opening paragraph of this paper.

Historical Sketch.—On looking back upon my personal history, I can truthfully state that I discovered the principle of treatment in question, and invented and applied the apparatus for carrying it out, without the knowledge of anything similar having been done by any other. The method, which I am happy and proud to think has within the past *few years* already worked a most beneficial change in the management of joint diseases and deformities, both in this country and abroad, did not flash upon me intuitively, but was the result of frequent and anxious reflection, and was reached only after much experimentation. Yet on searching the history of the subject, I find that I have had some predecessors, who have pioneered in the right direction. Says a reviewer: "Reforms of any magnitude are in no art so sudden as they at first appear; they are preceded by some foreshadowings, some travailing of advanced genius, some birth of a new truth into a world not ready to receive it; thus, it is certain that the expansive power of steam had been examined into, and the general plan of its application sketched long before the steam engine was applied to practical purposes. A sort of electrical telegraph was described long before Wheatstone made it. There is nothing new under the sun."[1]

Hippocrates and others.—The Father of Medicine made "extension," in cases of spinal curvature, from the chest and shoulders, and counter-extension from the loins and thighs by means of bands fastened around levers at the head and foot of a wooden couch, on which the patient ("and truly in those times a sick person fully deserved that name") was lying prone. But pressure was also made by "the physician, or some person who is strong and not uninstructed," upon the hump with the hand, or by standing or sitting upon it and pressing it down with the whole weight of the person, or the poor patient was fastened to a ladder projecting beyond his head and feet, and pitched down from a high tower or the gable of a house, usually head foremost. Hippocrates also describes club foot "to be adjusted by extension bands, properly secured by bandages and properly disposed of afterwards." It is of this treatment that he says: "This then is the mode of cure, and it neither requires cutting, burning, nor any other complex means, for such cases yield sooner to treatment than one would believe. However,

[1] British and Foreign Medico-Chir. Review, October, 1861, Review VII., from which also many of the following references are taken.

they are to be fairly mastered only by time, and not until the body has grown up in the natural shape."[1]

Ambrose Paré recommends mainly support and pressure; *i. e.*, an iron corset, consisting of a carapace and plastron, in which the body of a crooked-spined person is to be laced; and for "helping those that are vari and valgi, that is, crooked-legged or crooked-footed, inwards or outwards," collars and bolsters on that side whereunto the bones do lean and incline themselves, &c.[2]

Fabricius Hildanus seems to have been the first who devised splints for straightening the elbow and knee fixed in a bent position. He hinged two splints together lengthwise, and a screw lying across the angle at which they were joined served to open or to close it. For the knee, he has also a machine, formed of a single straight piece of thin iron, hollowed so as to fit the back of the limb; a screw passed through this near its middle, and was connected with a ring that encircled the knee and fixed a pad or shield lying over the patella. By turning this screw, the ring and of course the joint also could be drawn backwards. The same author has also recorded a case of contraction of the fingers after burns, and a method of cure "by means of finger-stalls, between which and a bandage above the wrist, threads are tightly strained."[3]

Glisson describes a mode of suspending children, so that their own weight produces extension. "The artificial suspension of the body is performed by the help of an instrument, cunningly made with swathing bands, first crossing the breast and coming under the armpits, then about the head and under the chin, and receiving the hands by two handles, so that it is a pleasure to see the child hanging pendulous in the air, and moved to and fro by the spectators. Some, that the parts may the more be stretched, hang leaden shoes upon the feet, and fasten weights to the body, that the parts may the more easily be extended to an equal length." Moreover, "to straighten the trunk of the body, or to keep it straight, they use to make breastplates of whalebone, put into two woollen cloths, and sewed together, which they so fit to the bodies of the children that they may keep the backbone upright, repress the

[1] Sydenham Society, vol. i. p. 632.

[2] The Works of that famous Chirurgeon, Ambrose Parey, first published during the years 1545–1575. Translated out of Latine, and compared with the French, by Thomas Johnson. London, 1649.

[3] Observationum et curationum medico-chirurgicam centuria. 1641.

sticking out of the bones, and defend the crookedness of them from a further compression."[1]

Heister employed a machine resembling a cross, made of thin steel, to each of whose four extremities a leather band was fixed; the upper and lower for the neck and pelvis, the two lateral ones for the shoulders. The necessary extension was kept up by weights.[2]

Audry recommends inunctions, gymnastic exercises, bandages, and splints, saying, "The same means must be taken to straighten them (crooked legs, &c.) as are adopted for straightening the crooked stem of a young tree."[3]

Le Vacher's machine for the spine consisted of a corsage strongly set with whalebone, carrying a metal socket with a staff. This staff, being crooked, overhangs the head, supports a portion that grasps the forehead and occiput, and can be more or less gradually lengthened or shortened in its socket by means of a ratchet and lever, thus supporting all that part of the spine between the socket and head, but, be it observed, by means of the thorax.[4]

Schmidt invented an instrument, described as "a metal band passing round the crista ilii, supporting two branches, which run up to below the armpit and terminate like crutch handles, being kept in place by another band of metal that runs round the back of the shoulders."[5]

Darwin devised two spinal machines, the one for a sitting, the other for a recumbent person. The first consists of an arm-chair, with a square upright back, to each arm of which is fastened a crutch-handled support, which goes under the axilla of the patient, whilst to the back is affixed a crooked iron staff, from which hangs a well-contrived apparatus for grasping the head and partly supporting the weight by the neck. The other is only to be used when the patient is lying on a bed, which should slope from the head to the foot about twelve or sixteen inches; a machine which supports the head by the jaw or occiput prevents the patient sink-

[1] De Rachitide, translated by Nich. Culpepper. 1651.

[2] Heister's Chirurgie. 1739.

[3] L'Orthopédie; ou, l'art de prévenir et de corriger dans les Enfans les difformités du Corps. 1741, vol. ii. p. 282. In this book, the terms orthopedia and orthopedie occur for the first time.

[4] Le Vacher's account of his machine was published in 1784. Med.-Chir. Rev. cit.

[5] Account published 1794. Med.-Chir. Rev. cit.

ing down in the bed, and keeps up a constant though gentle extension on the spine.[1]

Chessher appears to have stretched the trunk with a windlass, and then to have fastened his collar and support upon the back, while the extension continued, "so that the patient could walk and move about with a constantly stretched spine."[2]

Shaw's mechanical couch is inclined, like Darwin's, but "the flat portion, on which the patients lie, consists of two parts: the upper one fixed, the lower capable of sliding down on the framework of the couch; the patient lies with the shoulders on the upper, the loins and buttocks on the lower part of the couch. When this latter is released, the tendency to slide down produces a certain amount of extension, which can be increased by the addition of weights, while a headstall may be applied, which prevents the patient being dragged down, and causes the extension to be more evenly distributed throughout the column."[3]

Guérin's couch is also "a plane slightly inclined, though its inclination is not meant to produce extension, for which purpose a windlass and straps fastened to the loins are used, the head being confined in a complicated apparatus. The plane part of the couch consists of three portions, the upper and lower of which can be turned on pivots to the right or left, so that each curved part of the patient's trunk may be screwed into a shape contrary to that assumed by the deformity."[4]

Verral's prone couch, for angular curvature, is one in which "the patient is kept lying on his stomach, with his head in a hole, for some months; that is, until, in favorable cases, the curvature has healed; the position seems at first sight unbearable, but patients generally affirm it to be comfortable."[5]

As to inventions of apparatus for the limbs, these were, until recently, mainly limited to that for clubfoot. Towards the end of the last century, there were Tiphaisne and Verdier in France, Jackson in England, and Venel in Switzerland, who acquired considerable reputation in the treatment of clubfoot. They kept their appliances secret, however. But a patient of Venel gave a description and a card-board model of the machine used by the latter to Dr. Ehrenmann, who thereafter had an iron one made. Brückner of

[1] Zoonomia, vol. ii. p. 90, 1796. Ibid.
[2] Med.-Chir. Rev. cit.
[3] Ibid.
[4] Med.-Chir. Rev. cit.
[5] Ibid.

Gotha saw this instrument and copied it; and Naumberg of Erfurt also procured an imitation. These three surgeons treated several cases with this instrument. Brückner[1] and Naumberg[2] founded on such treatment works on the subject. The imitation of Venel's machine was used as follows: The foot was first fastened in a leather buskin with a strap attached; then, while thus covered, it was placed in an iron box and the strap assisted in holding the limb immovable. The iron box or shoe is a very complicated apparatus with a staff or lever to run up the leg, and is composed of movable plates, screws, etc., which gradually squeeze the part into a normal shape, while the staff, turning the foot on its long axis, causes the sole to face directly downwards instead of inwards. One great feature of the treatment was the slowness with which it was commenced, the machine being at first applied only for an hour and with very little tension daily; then both time and force were gradually increased until the child could bear its application during the night. It generally took two years to complete the cure.

Sheldrake, an English mechanician and truss-maker, constructed an instrument, in which for the screw power he substituted a spring, "so adapted to the nature of the distortion that, when bound upon the limb, its action will draw the deformed parts into their natural situation. When it is necessary to allow of motion in the limb, that motion, by increasing the reaction of the spring, accelerates the cure."[3] Scarpa, the celebrated Italian physician, used an apparatus which is still employed and known as Scarpa's shoe. It is similar to the imitation of Venel that I have described, only that Scarpa also substituted spring power for the screw force. The idea of the elastic spring he is said to have derived from Tiphaisne, and in connection therewith the following anecdote is recorded: "In the year 1781, during his residence in Paris, he passed, by chance, Tiphaisne's door, which was hung around with pictures of sundry monstrosities and deformities. He learned that these were taken from the feet of children whom Tiphaisne had perfectly cured, and immediately he tried to make acquaintance with that specialist. Scarpa saw him frequently; but his oft-repeated visits and questions extracted nothing from one so jealous

[1] Brückner, Ueber einwärts gedrehte Füsse, 1798.

[2] Naumberg, Abhandlung über Verkrümmungen, 1796.

[3] Observations on the Causes of Distortions of the Legs of Children, and the consequences of the pernicious means generally used with the intention of curing them. By T. Sheldrake, 1794.

of his secret as Tiphaisne, except on one occasion when he said, 'Nature will not yield to violence, but only to a gradual force'—a phrase which still further stimulated the Italian's desire to see the instrument. After many useless attempts, he at length succeeded, by means of the housekeeper, in penetrating, for a few minutes, into Tiphaisne's inner room where the patients were treated, but this only after giving his word of honor that as long as Tiphaisne lived he would neither say nor write anything on the subject. Scarpa, however, found nothing more than a steel spring lying on a cushion. This single part of the apparatus enabled a man so thoroughly acquainted with anatomy to construct (after a few experiments on spring power) the present shoe, which, if not exactly like that of Tiphaisne, is hardly likely to be inferior to it in efficacy and perfection."

About the beginning of this century, Scott obtained a very extensive popular reputation for the cure of diseases of the joints. His method of treatment was published by his son, a London surgeon. It was applicable only to chronic conditions. ("His remedy is inadmissible as long as inflammation exists in the joint, which it is sure to aggravate."[2]) It consisted in a complicated mode of plastering and bandaging that doubtless often did good on the principle of obviating muscular contraction, a principle not thought of, however, by Scott.

Harris published three or four cases of "extension and counter-extension being resorted to as a curative means in morbus coxarius." The apparatus he used was Gibson's modification of Physick's long fracture splint.[3]

Brodie says: "At a later period when, in consequence of the extensive destruction of the articulation, the muscles begin to cause a shortening or retraction of the limb, I have found great advantage to arise from the constant application of a moderate extending force, operating in such a manner as to counteract the action of the muscles. For this purpose, an upright piece of wood may be fixed at the foot of the bedstead, opposite the diseased limb, hav-

[1] Preface, p. iii., of Malfatti's Translation from the Italian into German of Scarpa's work: Sulle Piedi Torti. (Originally published in 1803.)

[2] John Scott on the Treatment of Diseases of the Joints. Republished by William Henry Smith. London, 1857. (Originally published in 1821.)

[3] Report of Cases by Dr. William Harris, published in Philadelphia Medical Journal, 1839. Am. Med. Monthly, editorial, May, 1861. Am. Med. Times, April 27, 1861.

ing a pulley at the upper part. A bandage may be placed around the thigh above the condyle, with a cord attached to it, passing over the pulley and supporting a small weight at its other extremity. I will not say that the effect of such a contrivance is to prevent the shortening of the limb altogether, but I am satisfied that it will, in a number of instances, render it less than it would have been otherwise, at the same time preventing or very much diminishing that excessive aggravation of the patient's sufferings, with which the shortening of the limb is usually accompanied."[1] He adds, however: "It is never prudent to have recourse to any mechanical means for the purpose of preventing anchylosis taking place, lest a fresh attack of inflammation and abscess should be the consequence."[2] And further: "In most instances, some contrivance may be employed, having for its object to maintain the diseased joint in a state of absolute immobility; and this should be always regarded as one of the principal points to be alluded to in the surgical treatment."[3]

March also recommended in the latter stages of morbus coxarius extension of the limb for preventing and obviating the deformity; but his plan was to make extension to bring the limb in its proper place and secure it fixedly by an improved splint of his own invention.[4]

Bauer devised an apparatus "to secure rest and position for an affected hip-joint," which he termed "wire breeches." It is similar to the *double gouttière* of Bonnet, of Lyons, having however attached to it a foot-piece allowing of extension. "The principle of the wire breeches had been borrowed from Hagedorn-Dzondi's splint."[5]

The list of those who have preceded me in publishing something relating to the *mechanical treatment* of either spinal curvature, club-foot, and other deformities, or of diseases of the joints, is of course a very long one. I have mentioned the various modes proposed and practised from the "beginning of medicine," as far as I have been able, and leave others to judge how much I might have been

[1] Pathological and Surgical Observations on the Diseases of Joints, by Sir Benjamin C. Brodie, Bart., F. R. S., Sergeant Surgeon to the King, and Surgeon to St. George's Hospital, with alterations and additions. From the fourth London edition. Boston, 1842.

[2] Ibid., p. 218. [3] Ibid., p. 147.

[4] Transactions American Medical Association, 1853.

[5] New York Journal of Medicine, 1853. The quotations are from remarks of Dr. Bauer before the New York Academy of Medicine, Bulletin of April 3d, 1861, Am. Med. Times, May 4th, 1861.

aided, had I earlier been familiar with the *entire literature of the subject.* I shall analyze the various modes presently.

I do not propose to speak in this place of the historical development of the constitutional and local medicinal treatment, nor to mention as to the operative surgical treatment, further than the data that Isaac Mincius seems to have been the first who performed myotomy for the cure of wry-neck.[1] Thelenius extended this idea, and in a case of equina-varus, divided the tendo-Achillis and the skin together in 1784. Sartorius in 1806, and Michælis in 1809, repeatedly performed the same operation. Delpech had recourse to it in 1816 and greatly improved the procedure, while Stromeyer perfected it and originated the subcutaneous method in 1831. Dieffenbach adapted it to cases of strabismus, and applied it more largely to contracted and distorted joints. Guerin divided a great number of the dorsal muscles in cases of curvature of the spine, etc. Who the first was who proposed puncture to relieve the effusion into diseased joints, I have not been able to ascertain.

Analysis of the various apparatus proposed from the time of Hippocrates to the period at which I entered upon the investigation, shows that the principles whereon the treatment was founded were *pressure, occasional* or *inelastic extension, more or less constant support, immobility of the parts* and *division or rupture of contracted muscles, with retention of the part in a fixed position thereafter.* These principles are not carried out, however, in each apparatus, and the mode of applying them was certainly very rude at first; but we can trace progressive improvement from the ladder, splint, and bandages of Hippocrates to the couch of Shaw, or the wire breeches of Bauer.

In the acute or earlier stages of joint diseases, "immobility," "absolute repose," "recumbent posture of patient and joint," "rest of the affected joint as well as of the whole body," were universally deemed the *desideratum*, "*the one thing needful*," until my mode of treatment became known. And if some "had never felt satisfied that something more might not be done,"[2] others seemed to have been desirous of and satisfied with obtaining an anchylosed joint with the parts in the best position. *I insisted from the first* on the fact, that mobility is natural to and required by a diseased as

[1] Tulpius, Observationes Medicæ, lib. iv., cap. lvii., p. 372, 1685. Med.-Chir. Rev. cit.

[2] As Dr. Bauer said of himself in his remarks before the New York Academy, already cited.

well as a healthy joint, and introduced that as one of the principles of my treatment. I insisted also from the first on the fact that pressure, mostly owing to muscular contraction, is the most active agent of destruction in the morbid process, which it is the object of my treatment to overcome; and I, therefore, directed my efforts to obviating, *in all stages of the morbid process*, the pressure to which the parts diseased are exposed. To attention to this, I ascribe mainly my success.

The distinctive principle of my treatment is the procuring to the diseased structures, *support without pressure*, and *motion without friction*. The treatment itself, concisely defined, *consists* in *abtraction* of the joint affected, by *continued elastic extension*.

The word *extension* has misled so many well-informed physicians, that I must dwell on it again, although I have alluded to it already. Many have averred to me that they cannot comprehend in what really consists the difference between my mode and some of the means previously employed, or in what the "*extension*" *produced by my apparatus, really differs from ordinary extension*. Yet, it seems to me, that on a little reflection, enough distinction can be *appreciated between a force that fixedly sustains* a limb *in a position, previously more or less extended* and a force that is actually and actively extending all the time, *i. e.*, that exerts a constant pulling power, instead of merely preventing immovably the retrocession of *pulling previously exerted*.

Essential parts of apparatus.—The essential parts of the apparatus are, simply, means of exerting an *elastic continually-extending* force on one side, and a resisting, counter-extending one on the other, and the essential part of the construction is, that while carrying out the *principle of treatment* (viz., the securing to the diseased structures support without pressure, and motion without friction), it "permits the patient to walk about, and so does not injure his health:"—a requisite for the patient's recovery, insisted on by Sheldrake and Scarpa for clubfoot, occasionally acted on also in spinal curvatures, but *never* thought of in joint diseases, or at least *never attained*, as far as I know, *previous to my time*.

Improvements as to Material and Mode of Application.—As to the material used, and the mode of applying it, I believe I have also introduced some improvements useful for other surgical appliances as well as for my own apparatus. Adhesive plaster had first been recommended for extension and counter-extension in fractures, by

Gross.[1] I was the first to have it spread on twilled goods, and to point out certain chemical changes necessary to be effected in the oil of the plaster, to secure its firm adhesion to the skin, particularly during hot weather; also its application to parts in the manner now universally known, to increase its retention, and yet obviate undue local compression.

The peculiar form named "corrugated" cast steel, combining strength with lightness, a great desideratum in surgical instruments, I introduced, and I also introduced the "artificial muscles" of rubber into general use, in connection with which I beg leave to quote from one of my earlier papers, published in 1856. "There is one point in my mode of making extension which, I think, *from the long experience I have had in its use*, would be an improvement upon the general mode—and it is equally applicable in *all extensions and counter-extensions, those of fractures* as well as *contracted muscles* —viz., the use of *rubber* as an *extending power. This will act steadily and gradually without any violence,* and with very little suffering in comparison with permanent fixtures. When contracted muscle is to be overcome, it steadily wearies it until it quietly comes off conqueror. *I would earnestly recommend the Profession to give their attention to the use of this article for the accomplishment of extension.*"

I have given the date at which I commenced my mode of treatment. I have *never* made a secret either of my apparatus, the mode of applying it, or the conjoint medical and surgical, constitutional and local treatment that the individual cases require; *on the contrary,* I have, whenever occasion offered, *verbally* and *in detail, explained all* to my professional brethren, *urged the trial* upon them, and have given them all possible facilities for using it. Residing, as I did, however, in a country town of a few thousand inhabitants, in the centre of Massachusetts, and not infected with the "cacoethes scribendi," my success was not immediately trumpeted throughout the medical world, although all the neighboring physicians, and a few of eminence at greater distances, such as Dr. Miller of Providence, R. I., Dr. Buck of New York City, the late Dr. Twitchel of Keene, N. H., and many of Boston, Mass., knew of my treatment.

In 1855 I removed to the metropolis of New York, and immediately, at one of those pleasant social and scientific reunions given at that time by Prof. Parker, I had an opportunity, by special invitation, to lay my improvements before a larger medical audience.

[1] Gross on the Bones and Joints, 1830. Am. Med. Monthly, May, 1856, p. 330.

I was introduced by Dr. Parker as having "some new views of the pathology and treatment of joint diseases and deformities," and my hearers were evidently struck with the results and peculiar advantages that my treatment promised.

In the March, May, and June numbers, 1856, of the *American Medical Monthly*, I published a lengthy article on "Deformities and their Remedies," in which the whole plan of my treatment is fully laid down. Soon after, Dr. Parker published in an editorial article of the same journal a very flattering account of me and my success; this article contained a description of the principle *on* which the treatment is based, and of the apparatus *by* which it can be carried out.[1]

In November, 1859, I reported "A Case of Pott's Disease, with Remarks on Morbus Coxarius, etc."[2]

About the same time I published an article "On the Effects of Pressure upon Ulcerated Vertebræ and in Morbus Coxarius, and the Relief afforded by Mechanical Remedies, with Cases."[3] I gave a very detailed description of my apparatus, its application, etc. etc., under the head "The Mechanical Means adopted in the Treatment of Morbus Coxarius. (With a Plate.)"[4]

A few months later I read, by special permission, before the New York Academy of Medicine, a paper on "The Pathological Basis of the Treatment of Joint Diseases," which was very largely published.[5] Next, I made, by invitation, some remarks before the Academy in a discussion on Morbus Coxarius.[6] I also collected "The Medical Testimony in regard to the Proper Mechanical Treatment of Joint Diseases" in pamphlet form, and distributed it widely to medical journals and the profession throughout the country.

This had been done to make my professional brethren at home fully acquainted with the mode, its advantages and superiority over all others. To diffuse the benefits of the treatment abroad, I sent out, as early as 1859, an instrument for morbus coxarius, by a medical friend, to exhibit it to the leading surgeons both in England and on the Continent. In 1860 I sent by another medical gentleman a second instrument, to be shown at all the principal hospitals.

[1] American Medical Monthly, March 1857, p. 187.
[2] Ibid., November, 1859.
[3] New York Journal of Medicine, November, 1859.
[4] American Medical Monthly, April, 1860.
[5] Bulletin of Academy, September, 1860.
[6] Ibid., April 3, 1861. Am. Med. Times, May 16, 1861.

In the mean time, allusions to my method had been made in several journals, medical and lay, and a number of imitators soon published "modifications" and "improvements," some without and some with giving me credit for the origination. Without going into detail, I may mention the names of Drs. Barwell, Sayre, Andrews, Hamilton, Taylor, E. O. Cooper, Alcott, Vedder, etc., as among those who took up my treatment, and practised it with greater or less success.

How undeserved the remark of Dr. Bauer in 1861 was, viz., that he could "not help regretting that Dr. Davis should have withheld from the use of the profession and the comfort of so many sufferers, such an excellent appliance,"[1] is made apparent from the preceding, and is answered by the following quotation from the introductory remarks to the detailed description of my method long before published. "I have delayed bringing the subject of this paper before the profession until time had given me an opportunity, not only to overcome any minor difficulties that might arise, but also to test its application, and compare the results with the modes heretofore practised. It is an unfortunate circumstance that so many new things are hurried before the profession in a crude state, to be condemned or die of neglect, when they could have been highly useful if the inventor or discoverer had taken time to digest and mature his plans, and then apply them until all objections or difficulties were overcome."

Summary of the Pathological Basis of the Treatment.—The careful reader will find running throughout the whole of this paper, and indeed through all the papers that I have published on the treatment of joint diseases since my first case of spinal disease in 1837, an opinion as to the causes operating to destroy, not only cartilage, but also bone, which differs materially from that hitherto generally entertained by the profession, and which forms *per se* the pathological basis of my method of treatment. It is, *that pressure upon the articulating surfaces plays an important rôle in the destructive process going on in diseased joints.* In the essay on this subject, which I had the honor to read several years ago before the New York Academy of Medicine, I have accounted for the difficulty of procuring from books direct evidence upon the point involved, by showing that those who have examined and reported cases, have not so recorded their observations as to give the desired information; for, not recognizing the true causes of the lesions discovered,

[1] American Medical Times, May 4th, 1861, p. 297.

they have given but a partial narration of the facts their examination would have revealed, had their attention been properly directed. Again, to illustrate, cases of fracture of the neck of the femur are reported, that had been under treatment by the straight splint for months. In the *post-mortem* reports, the state of all the articulations below that of the fracture are detailed, while that of the hip, the seat of the injury, is omitted.

Had the condition of the hip-joint been given in every instance of fracture of the neck of the femur, treated by the straight splint, and the result of dissection recorded, together with the description of the other articulations of the injured limb, the array of facts would have been abundant. As it is, I have obtained two cases from the books, in which all the facts having a bearing upon my theory are fully detailed.

I beg leave to quote a little more fully from the essay referred to. "During the course of inflammatory processes in and about the joints, after they have advanced to a certain point, the joint becomes in a measure fixed, and not unfrequently so much so, as to resemble true anchylosis. The time necessary to produce this result varies according to the character of the structure inflamed.

"Nature appears to establish this immobility of the parts as a remedial measure, and, so far, it is safe to follow her guidance. In order to do this understandingly, however, let us inquire what is her aim and intention in thus rendering the joint immovable. It undoubtedly is to protect the surfaces of the joint (that come in contact in the natural movements of the limbs) when diseased from friction. The pain which friction causes prompts the sufferer to second this intention of nature by his voluntary efforts. So far as this object can be accomplished by the muscles holding the joint motionless, they so act. Now, in effecting this immobility, are the muscles of the diseased joints relaxed, and therefore at rest; or, are they in a semi-contracted state, and thus fix the joint by acting equally on every side of it? It would appear, from some facts I shall adduce, that the latter is their condition.

"In inflammation in and about joints, when it has advanced to a degree that renders motion painful, if any attempt is made to flex or extend the limb, the motion is communicated to the part beyond, in a similar manner as when the joint is anchylosed.

"This immobility in some cases may be in part produced by the tumefaction accompanying the inflammatory process; but tumefaction is not necessary to the result, for in the very cases of chronic

morbus coxarius where no swelling exists, the immobility is most marked. Anæsthesia has been produced in these cases without relieving the fixed state of the joints; yet that there was not true anchylosis, was proved by the perfect freedom of motion after a few days of treatment by elastic extension.

"Again, in a limb with disease of the hip-joint that has been under treatment until it will admit of flexion and extension readily if moved gently, yet if handled a little roughly, all the muscles will be upon their guard, and the pelvis will be found following every motion of the femur.

"If it is true that the diseased joint is held in a fixed position by a certain rigidity of the muscles passing to or beyond it, an amount of pressure corresponding to the contractile force of the muscles, as then exerted, must be produced upon the articulating surfaces of the joint. The inquiry may be made—Does not the joint in health sustain a much greater amount of pressure with impunity? To answer this question, let us examine a particular point in the mechanism of certain joints of which the knee furnishes an example. The lower portion of the femur terminates in two condyles, each of which presents an articular surface, narrower, but at the same time more extensive, antero-posteriorly than the corresponding articular surface of the head of the tibia. Not the whole, therefore, but only a part of the articular surface of the condyle can be in contact with that of the tibia at any moment; and the precise portion in contact varies with every variation of flexion and extension of the knee-joint; this will be evident, when we consider that the concave surface of the head of the tibia and the convexity of the condyles of the femur do not correspond. When the limb is in exercise, or when its position can be frequently changed, no difficulty arises from the contact and pressure, because then the point of pressure is constantly changing, and when not in exercise, its position is altered whenever any inconvenience is experienced. In health, therefore, the pressure is never exerted upon any one point for a great length of time continuously, but is ever changing from one part of the whole surface to the other.

"It is for this reason that the joint in health can suffer the weight of the body to rest upon it without injury; but when the parts are fixated by disease or artificially, the pressure, whether it be a portion of the weight of the body, or only the contractile power of the muscles (as exerted in fixing the joint), falls entirely upon a small portion of each condyle, and a corresponding portion of the head

of the tibia in contact with it. If it is admitted that only a small portion of the articular surfaces of the condyles and the tibia are in contact at any given time, in the normal condition, we are prepared for the inquiry, What will be the result of continual pressure, effected by the contractile force of the muscles while fixing the joint; a compression from which there may be no relief for weeks or months in succession?

"The effect of continued, unremitting pressure upon other portions of the body is well understood.

"Every practitioner cautions his pupils not to allow the heel to rest upon the bed while treating a case of fracture of the lower limb, warning him that, if he does so, the parts will slough; this result takes place, not because of the *severity* of the pressure, but from its *persistency;* from its not allowing, by change of position, the circulation, and consequently nutrition, to proceed uninterruptedly. The liability to this casuality increases, the less sensibility there resides in the structure affected. It is also promoted by diminished vitality. We can hence easily understand why it so readily takes place in the heel. I would call attention to this fact, as I shall have occasion to notice the importance of its consideration when applied to the effect of pressure upon cartilages.

"There are two reasons why diminished sensibility and nutritive endowment should render parts liable to destruction by pressure. First, the sensibility being slight, death of the parts occurs with very little suffering. Secondly, the vitality being low, less pressure is required to interrupt the vital functions, and thus cause death.

"I trust that I shall be able to show conclusively, that in inflammations external to the capsules of the joints, sufficient to render them motionless, absorption, if not death, results to those portions of articular cartilage in contact and pressing upon each other; that this occurs when the external disease has not extended to the articular surfaces, and that it is owing chiefly, if not entirely, to continued pressure; this pressure being limited to that portion of the articulating surfaces that are held in contact for a period of time, without intermission or change, by the muscles which control the motions of the joint affecting the parts, precisely as pressure does when applied to the surface of the body, viz., producing absorption, when not sufficient entirely to arrest the nutrition of the parts, and when going beyond this point, death, with exfoliation of the parts pressed upon. For *this is precisely the result* we find in joints rendered immovable by artificial means. If this result follows from

pressure in a previously healthy articulation, how much more destructive must be the process in a joint whose vitality is depressed by disease!

"This view renders intelligible the *modus operandi* by which cartilages and bones, in some instances, are so rapidly destroyed. This result to cartilages from pressure is rendered more readily admissible when we consider the manner in which they are nourished. Cartilages are without bloodvessels and nerves of their own; those of the surrounding parts terminate at their surfaces; those of the synovial membrane at its junction with the edge of the cartilage; those of the bone at its point of union with the cartilage. It is not necessary for my purpose to show the precise way in which cartilage is formed, only that it is possessed of a low grade of vitality. In respect to its mode of nutrition, the cartilage resembles the cornea; and, as the effect of imperfect nutrition upon this portion of the eye has been fully established, I would direct attention to this point to illustrate the influence of like causes upon the cartilages. The justness of the comparison will be admitted if we keep in mind the similarity of their modes of receiving their nutritive supply. In experiments instituted by physiologists upon the inferior animals, it was shown that the cornea was readily affected with ulceration, when they were fed upon certain articles of food that did not furnish them with proper nourishment. I mention this fact to show how easily parts which are not supplied with bloodvessels take on the *ulcerative process*. In the case of the cartilage, the cause is mechanical which interferes with nutrition, but the results to the parts immediately acted upon is the same, viz., deficient or interrupted nutrition by reason of uninterrupted pressure. That this result follows, is proved by an anatomical fact that the centre of the ulceration is always at the point of greatest pressure, as revealed on dissection.

"There is yet another reason, founded upon the structure of a joint, why continued pressure with immobility should be attended with danger. The cartilage being an elastic substance, and affixed to the ends of two bones whose surfaces do not precisely correspond with each other, the greatest amount of pressure must come upon the centre of those portions in contact, gradually diminishing to the circumference; in this respect they are unlike two solid bodies, where the pressure would be equal upon all the parts in contact. The difficulty that would arise from this construction of the parts in a small articulating surface like the hip-joint, where it is sub-

ject to great pressure, is somewhat obviated in this joint by a thickening of the cartilage around the upper surface of the acetabulum, in the form of a ring, which admits the extreme upper portion of the head of the femur to pass into it; thus presenting a larger surface to receive the pressure than would have existed had the cartilage been of an equal thickness throughout.

"When a joint or limb is rendered immovable, its functional law is violated, and a corresponding penalty incurred, viz., that following the loss of its accustomed exercise. A part suffers from this cause in proportion as its normal condition is one of greater or less motion; the joints and muscles must, therefore, suffer more in proportion than any other part of the body. This effect of rest has been noticed by authors as manifesting itself by ecchymosed spots upon a limb, as well as in a joint, rendered immobile; while its fellow not kept motionless, was not so affected. Rest alone might not be sufficient to produce, in a particular case, very deleterious effects; but when we add to it continued pressure, and that, perhaps, applied to parts already somewhat enfeebled, we have influences that are potent for evil—influences that have wrought the destruction of many limbs, if not lives."[1]

[1] It gives me great pleasure to reproduce here the communications addressed to me, upon the point under consideration, by some of the most eminent surgeons among us.

September, 1860.

DEAR SIR: I have received your note of inquiry as to my observations in joints where the same points of surface have remained long in contact with the pressure of the muscles.

I beg leave to reply, that I have often *seen in the knee-joint, after amputation, when the joint was opened, that where the surfaces had remained long in contact, the synovial membrane and cartilage were removed by absorption, and the bone at the same point dead for from an eighth to half an inch in depth.*

In exsection of the knee-joint, on opening the cavity, I have found the same destruction to have occurred. The same pathological condition is observed at the hip-joint. Indeed, I regard it as established, that if the surfaces of the joints be allowed to remain long in a fixed position, the pressure from the muscles causes destruction of the substance making the wall of the joint. We see the same condition resulting in the joint, that happens when pressure is allowed upon the heel in the management of fracture—viz., ulceration and sloughing.

The more feeble the patient, from scrofula or otherwise, the greater the danger from pressure.

You particularly called the attention of the profession to the above pathological state, in the American Monthly, some five years ago, I think. You then stated the great importance in the treatment of hip diseases, &c., of keeping the surfaces of the

In two cases mentioned by Bonnet, of Lyons, *all the articulations*

joints from pressure by the application of extending and counter-extending force, and referred to the great value of India-rubber in applying the power.

The application of the splint in hip disease to establish extension and counter-extension, and at the same time permit the patient to walk and live in the air, as you have practised for years, is a matter of great moment. You have laid the profession and the public under lasting obligation. Yours truly,

WILLARD PARKER.

To H. G. Davis, M.D.

New York, Sept. 3, 1860.

My Dear Doctor: On looking over my notes of dissections of diseased joints, I am sorry to find that the point about which you are most interested has not, in any one of them, been particularly noted, and I fear that you will find this to be the fact with most of the published cases, as it is a point to which the attention of observers has not been particularly directed. Since our conversation, however, I have seen the dissection of two knee-joints, amputated at the New York Hospital, which bear upon the point at issue. The first of these was a patient of Dr. Watson, who had been injured, I think, by a railroad contusion, some weeks before amputation. Suppuration and opening of the joint occurred, and, during his confinement, the limb was kept on an inclined plane at a slight angle. *On examination after amputation, we found the usual condition of synovial infl. and suppuration, but precisely at the spots where the condyles of the femur pressed upon the surfaces of the head of the tibia, there ulcerative action had gone on to so great an extent that the bone was exposed and already carious. This was the case on both the femoral and tibial surfaces of the articulation, and was the more striking, as in all the remaining portion of the joint, which had not been exposed to pressure, little or no ulcerative action had taken place.*

The second case was one in which the knee was amputated by Dr. Parker, for long-standing disease, where the joint had been open by an incision some weeks before the operation. We found here more extensive general arthritic degeneration, *but the ulcerative action was almost entirely confined to the points at which the bones had been so long in contact. At these points the disorganization had reached a point very nearly equal to that described in the first case, while the other parts of the articular surface showed thickening, vascularity, obliteration, superficial erosion, &c., but no deep or extensive ulceration.*

With regard to the other matter we were talking of, viz., the situation of the pus in cases of diseased joints, my notes are more explicit. I find I have recorded eleven dissections of joints which had undergone suppuration, either in the course of chronic disease, or in consequence of injury, seven being cases of chronic disease, and four of injury. In all these the dissection was conducted by first opening the cavity of the abscesses and noting how near they approached to the synovial membrane, and then by carefully opening the joint at some point where it was not covered by the abscesses, and carefully tracing the continuity of the synovial membrane. Thus examined, we found that in every case of chronic disease the abscess was external to the synovial sac of the joint, though generally approaching it in several points, so that only the thickened serous membrane intervened between the abscess and the synovial cavity. From these points of contact the abscesses were found to extend irregularly in all directions around the joint, forming numerous cavities and sinuses, all communicating with each other,

below the seat of the fracture were disorganized, while the hip-joint, the

but not communicating with the cavity of the joint, except in one instance. In this case a narrow and tortuous track of communication was found between the extra-capsular abscesses and the cavity of the joint, which cavity contained pus. This was the only instance in which, in this class of cases, we found any pus in the joints, or any communication with the abscesses, some of which were exceedingly extensive, and of very long standing. In this exceptional case the abscesses had existed for a very long time, were entirely extra-capsular, and only communicated with the joint by the small track described.

In the four cases of disease originating from injury, an entirely different condition of things was found. In these the synovial sac was the seat of the suppurative action, and no extra-capsular abscesses existed at all. In the cases where the abscess had not been evacuated before the dissection, the synovial sac was found distended with pus, and in one instance it had given way, and the matter was beginning to burrow up the thigh. In the cases where the joint had been for some time open and discharging, the synovial sac was, of course, not distended, but it marked the limit of the suppurative action, though itself, as well as the cartilages, were much more extensively destroyed than in the cases of chronic disease. As these eleven cases of joint disease were not selected cases, but embraced all I had a chance of dissecting during the period of observation, some three or four years, I think they may be taken as indicating the general features of the anatomy of the disorder in its two phases, though of course it would not be safe to consider any pathological point settled by so limited a number of observations.

Hoping to hear from you again on these subjects, which seem to me to have most important practical bearings,

I remain very truly yours,

T. M. MARKOE.

NEW YORK, August 20, 1860.

DEAR DOCTOR: In thinking over the many cases of diseased joints which I have examined, after amputation and otherwise, my impression is strong that the greatest amount of disorganization has generally existed at those points where opposed articular surfaces have been habitually in contact with each other. This is, however, a general impression only, as until recently my attention has not been directed to this particular point of inquiry. A recent case in which I exsected the knee-joint in a young woman for chronic strumous synovitis, afforded strong and indubitable evidence on the point in question. *In the centre of each of the articular depressions of the head of the tibia, I found a necrosed plate of bone, each about the size and thickness of a dime, lying loosely upon a bed of granulations.* The articular surface was elsewhere profoundly altered, but except at these points, not beyond possibility of repair to the extent of anchylosis. I was gratified in recognizing the necrosis in this case, as it demonstrated the propriety of the operation of exsection, which was followed by an excellent result, the patient recovering with an exceedingly useful limb. *The points of necrosis, you will have noticed, correspond with the localities upon the head of the tibia, with which the convexities of the two condyles of the femur have been in most constant contact.*

My friend, Dr. Krakowitzer, informs me that in a recent successful case of exsection of the knee for similar disease, *he encountered the same appearance at the same points.*

I have heretofore believed on the evidence adduced by Bonnet, of Lyons, in his

locality of the injury (the fracture being inside the capsule), remains in a healthy, normal condition.[1]

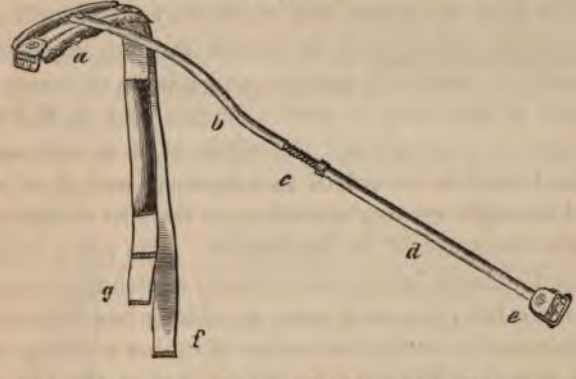
Prof. Valentine Mott corroborates the statement, that the point of greatest destruction is also the point of greatest pressure, varying according to the position of the limb during its period of immobility.

Description of Apparatus.—The apparatus, by means of which my treatment embodying the principles advocated in this paper can be carried into effect, is simple and easily explained.

It must be borne in mind, that I have already said that the essential parts of the apparatus are, means of exerting an elastic, continually-extending force on one side, and a resisting counter-extending one on the other.

The modifications it undergoes to adapt it to the various regions of the body, every physician can readily understand. I shall describe particularly the splint as applicable to the hip-joint. Reference to the wood-cut (Figure 1) annexed will further aid the reader.

Fig. 1.



An elastic perineal band (*g* in the figure) really constitutes the extending, adhesive plaster strapping around the limb, concentring

monograph upon diseases of the joints, that prolonged immobility of a joint was always followed by inflammatory action, and this has been confirmed by my own observation; but it is not improbable that the contact and pressure of opposed surfaces may play an important part in causing and aggravating the tendency to disorganization at the points of greatest pressure.

Truly your friend,

WM. H. VAN BUREN.

DR. DAVIS.

[1] Traité des Maladies des Articulations, accompagné d'un Atlas avec 16 Planches, par A. Bonnet, Professeur, etc. Paris et Lyon, 1845. Tome 1re.

at a point a little above the external malleolus, the counter-extending power, while a metallic splint (*b*, *c*, *d*, *e*) is stretched between these, and enables them to fulfil the indications proposed.

The splint is composed of four parts, viz., an upper or pelvic portion (*a* in the figure), a thigh portion (*b*), a leg portion (*d*), and an ankle portion (*e*).

The thigh portion consists of a metallic tube curved above (*b*), to correspond to the convexity of the thigh, and ending below in a short, straight piece, to which a long iron double-threaded screw (*c*), also hollow, is firmly secured. The leg portion is a straight metallic tube (*d*), closely investing the screw (*c*), and projecting but little beyond. It is attached to the ankle portion (*e*) in such a way that, in revolving it, in order to lengthen or shorten the instrument, only the screw investment with its nut is turned, while the ankle portion remains unmoved. This ankle portion (*e*) consists of a triangular-shaped, flat piece of metal, covered by a buckle (as seen in the figure).

The pelvis portion (*a*) is more complicated than the others. A slightly curved strip of steel half an inch or more wide, from four to six inches (both the length and width varying according to the size of the whole splint) long, is riveted through its centre to the free extremity of the thigh portion, and admits of rotary motion. At one end of this strip of steel a buckle, and at the other the perineal band is attached, and the whole of it is well cushioned. The perineal band is formed of two bands (*f* and *g*), of a length, width, and strength varying according to the size of the apparatus and the circumstances of its application. One (*f*) is longer than the other and inelastic, being made entirely of strong cotton or linen webbing, the other (*g*) is, as it were, an oblong bag of India-rubber webbing (formed by sewing two strips of rubber webbing together) filled with saw-dust, obtained by sawing across the fibre of pine wood (not lengthwise), tipped at each end with some of the inelastic webbing (such as (*f*) is made of). While the inside elastic band keeps up the extension required, the inelastic sustains any weight that exceeds the extending force as then applied to the patient. It is this arrangement that enables the weight of the body to be borne without harm, as in walking, and that prevents injury from excessive weight or pressure upon the articulating surfaces in cases of accident. Thus, for instance, the head of the femur would, in walking, be violently thrust upward, as the elastic band would yield to an increased weight, were there no inelastic, unyielding

band to prevent it; yet, it is obvious that this inelastic band does not interfere with the predetermined amount of tension to be exerted by the elastic one. (This amount of extension is determined and regulated as follows: Buckle the two bands unequally, *i. e.*, let the loop formed by the outside band be longer than that of the inside, and attach a weight to the latter. The number of pounds requisite to stretch the one loop to the exact length of the other represents the amount of extending force the instrument will exert, when exactly thus buckled, when applied upon the limb.

I will add here that the amount of extending force should be ascertained in every instance before fastening the splint upon the patient; this amount is not to be varied by altering, by means of the screw, the length of the instrument, but by adjusting the two bands.)

I have found the rubber webbing, with napkin protection to the skin, to be much superior to the rubber tubing. The tubing is seldom of the right elasticity, and is more liable to heat and excoriate the skin than the webbing, for the reason that it does not absorb the secretions, nor allow the air to come in contact with the skin.

The granular stuffing moves easily on itself and displaces readily, so as to equalize the pressure, as, for instance, over the adductor tendons in the groin.

The long splint is best adapted to the majority of cases. Some

Fig. 2.

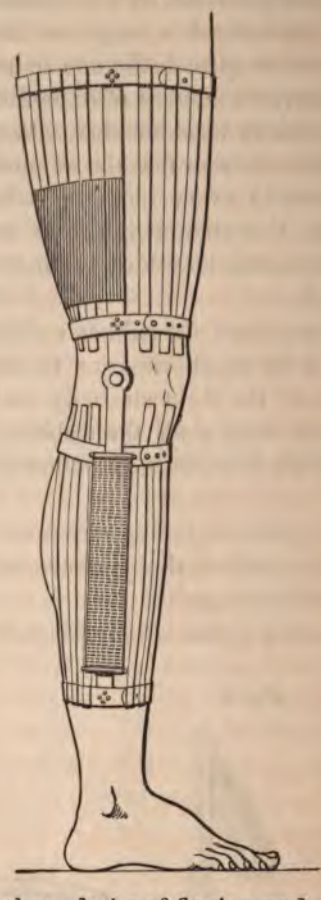
Fig. 3.

years ago, I was in the habit of applying a shorter one (Fig. 2) to the femur alone. This leaves the knee at liberty, and in so far is an accommodation to the patient, but otherwise is not so effectual. (Fig. 3.) A splint formerly used by me.

I also generally use the long splint for disease of the knee joint, applying the adhesive plasters only to the tibial portion of the limb. I have devised, however, a very convenient instrument (Figs. 4 and

Fig. 4.

Fig. 5.



5) for extension at the knee joint, that admits of flexion and extension of that joint, which in cases not too severe is sufficiently effectual.

Extension should be constant; when not accomplished by the splint, it should be by means of a weight and pulley.

Mode of Application.—Cut from a piece of adhesive plaster, spread on twilled goods and kept until the oil entering into its composition has become oxidized, two strips from 1¼ to 1½ inches wide, of the length of the limb from the pubis to the malleolus, and two strips a little narrower in proportion to the others, but one and a half

times as long. Fold about an inch and a half of one extremity of each of the first cut strips upon itself, the adherent sides to each other, and apply one on the outside and one on the inside of the limb, commencing with the folded end about two inches above the outer and inner malleoli, and extending it up in a straight line.

The other two strips are applied spirally around the limb as follows: Commence on the lower or folded extremity of the straight strip above the outer malleolus, and wind around in front and back, so that the two spiral strips meet in front, a little distance above the patella (as very well depicted in the wood-cut, Fig. 6).

Fig. 6.

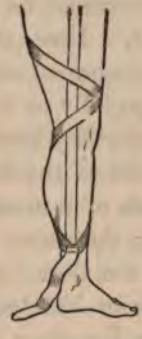


Fig. 7.

Next, sew a piece of firm, *inelastic* (linen or cotton) webbing, about $1\frac{1}{4}$ inches wide and from six to eight inches long, to the lower extremity of each straight strip, taking particular care to include in the attachment the ends of both spiral strips above the external malleolus. The limb is then closely and firmly enveloped with a common roller bandage, from the foot upwards (as shown in Fig. 7), the pieces of webbing only being left outside free. Now buckle the ankle portion of the splint upon the external face of the limb by means of the webbing; protect the skin of the groin and parts to be covered by the perineal band by a piece of old, soft napkin or table linen, several times folded and secured by a few stitches; and having previously adjusted the two bands composing the perineal band, as mentioned on p. 163, fasten the latter around the thigh, always taking care to have the buckle on the pelvic portion

of the splint in front; the screw of the splint regulates its length, so that the required amount of extension can be secured. When all is correctly arranged, and proper extension made, the upper extremity of the splint should fall just below the crest of the ileum.

Infrequency of Bony Anchylosis.—I now invite the reader's attention again to the quotation from my essay on "The Pathological Basis of the Treatment of Joint Diseases" (on page 154), in which I have mentioned the anchylosed condition of diseased joints. It is a fact of very great importance that *true* or *bony anchylosis* is of much less frequent occurrence than is usually supposed. *Apparent* anchylosis is due to the shortness of the attachments of the soft parts surrounding the joint. This is the condition of contracture of muscles; a *passive permanent shortening* and *rigidity*, a form of atrophy supervening after muscles have remained for a considerable length of time, morbidly contracted. How this change, which from its permanence may safely be regarded as structural, is brought about, is difficult to explain, especially as the opportunities for its thorough examination have been very limited.

Barwell thinks it is "located in the sheath of the fibres rather than in the fibres themselves. Every fibre of a muscle is composed of a sarcos and of an investing wall; the active contraction of a muscle is produced by shortening of the flesh; passive contracture appears to supervene after the interior has been for some time in this shortened condition, when the investing part adapts itself permanently to that shape, and each wall of every muscle cell is fixed in its abbreviated form. Moreover each portion of areolar tissue investing the fibrous bundles, assumes permanently the new form impressed upon it by the inclosed and contracted cereos. Such change does not forbid continuation of active contraction, for the state (contracture) depends upon change in the passive parts of the organ, to which ordinary muscular contraction may be added."[1]

I have quoted these views in detail, that the reader may have the full benefit of the Doctor's explanation. It appears to me, however, that a much more concise, and probable correct explanation of the change is, that all the loose, unnecessary material, including

[1] A treatise on Diseases of Joints, by Richard Barwell, F. R. C. S., Assistant Surgeon Charing Cross Hospital, etc. London, 1861; foot-note, p. 315.

not only the investing walls, &c., but the muscular fibre itself, is removed.

This is in accordance with a well-known fact resulting with other conditions, viz., that a part that is not needed under existing circumstances, is removed.

I have in a number of instances, secured for the patient full motion of the hip-joint, by continued elastic extension, after years of what was considered by prominent surgeons true anchylosis. In two cases this has been effected after a lapse of ten years. That it was dependent upon the causes mentioned, is corroborated by the process of restoration. There was no effort to break up adhesions by violence, but to place the soft parts in a state of *continuous tension.* This has been effected not only in *fixated* joints, but also in dislocations of long standing. I have never yet failed in securing motion in any case of *fixated* joint put under treatment for this purpose. That bony union may take place, I do not attempt to deny; my statement is this, *bony union is the exception, not the rule.*

Non-necessity of Tenotomy.—In this *contracted condition* it has been urged that the muscles cannot be stretched or elongated by any amount of extension short of rupture.

"On the contrary, any attempt at extension of a muscle in this condition only irritates it the more, and by persistence will produce chronic inflammation of its fibres, which, if continued, will always end in fatty infiltration and degeneration, after which it will never be restored to its natural contractility and elasticity. And the constitutional effects of a persistent attempt to extend an inflamed muscle are really as bad, if not worse than would be produced by the disease, if left to the unaided efforts of nature."[1] This is as erroneous and short sighted as the "TEST," on which the author relies for determining the necessity of tenotomy in these cases, viz., anæsthesia. Thus, "if when under the full influence of chloroform or ether, the muscles relax, and the position can be improved, then gradual and continual extension will accomplish the object; if, on the contrary, the limb remains immovably fixed under the anæsthetic, then section is necessary."[2]

Now this test simply proves, *if it really prove anything*, that the

[1] Objections to the Treatment of Morbus Coxarius in its advanced stages by extension, unless preceded by tenotomy. By Lewis A. Sayre, M. D., American Med. Times, May 9th, 1863.

[2] Ibid.

ligaments, muscles, and soft parts are actually shortened; that tenotomy is *necessary* to remedy this condition, is another question. I can assert with perfect confidence, a confidence derived from and confirmed by the experience of many years, that tenotomy is *not* necessary in such cases, and that it does not even expedite the cure. Besides, it has occurred occasionally, and but recently in the hands of Dr. Sayre (a case which terminated fatally), that the femoral artery has been cut by mistake, and the patient thus even runs a risk of losing his life.[1]

When *continued elastic extension is properly applied*, myotomy or tenotomy is seldom if ever necessary; but when *improperly* applied (*i. e.*, thoughtlessly and mechanically, as it undoubtedly was in the cases quoted by the author), there will necessarily be an aggravation of the suffering of the patient.

The result for good or evil depends entirely upon the *mechanical application* of the *extending force*. Under the influence of *continuous tension properly applied*, the muscles, ligaments, and other soft parts positively and absolutely elongate. There is no breaking up of muscular fibre and no mere stretching, but they *gradually grow*, *i. e.*, lengthen by deposit of new material. Dr. Barwell recently published a paper "On certain Grave Evils attending Tenotomy, and on a New Method of curing Deformities in the Feet," in which he advocates the application "really" of continued elastic extension in the following manner:[2]—

"A broad and long piece of strapping-plaster, spread on a thick material, is made to adhere over the origin of the muscle and along its course. Upon this is laid a piece of sheet tin, long enough to reach from the upper part of the leg to just above the ankle, and carrying at its upper part a wire loop; the piece of strapping is turned back over it, and lies with its adhesive side outwards. Another piece of strapping is placed on the foot upon the insertion and along the course of the tendon; the end of this strapping reaches to the bend of the ankle, and is folded over (the two sticky

[1] The only published account of this case appeared in No. 46 of the *Scalpel*, published in this city; this report has, I believe, never been contradicted, but has been corroborated by medical gentlemen who were present. The facts appear to be that the femoral artery was wounded, the cardiac side only was ligatured hemorrhage followed from the distal portion, causing the patient's death. This is only one of the direct liabilities of the operation; secondary accidents will occur, and are well known to surgeons.

[2] Braithwaite's Retrospect, American reprint, part the forty-fifth, p. 121.

sides opposed), and an eyelet let into it. An assistant is now to hold the limb as near as possible in the right position, while it is being smoothly strapped from the toes to the knee, leaving out the end (with its eyelet) of the piece on the foot and the wire loop at upper part of the leg. Between these two—the one representing the origin, the other the insertion, of the muscle—there is to be stretched an India-rubber spring, at a proper degree of tension. Thus, while there can be considerable force used in the direction of any muscle in the leg, the *point d'appui* is so supported by a loop of strapping, which takes its bearings from both the skin of the leg and the surrounding plaster, that no injurious pressure occurs anywhere. There are also some little contrivances for changing the direction of the force—as for the peronei tendons."

The fact of Dr. Barwell and others in Europe succeeding by this process, in elongating "contractured" muscle and ligamentous fibre, confirms my own practice. It is almost needless to add here, that the latter has led the way.

It will be perceived that I have limited my subject to the mechanical treatment of joint diseases and deformities. This does not interfere with any local or constitutional remedies that any practitioner may choose to adopt. To enter into the details of full therapy, and to speak of all the varying circumstances and necessities of every case of disease of the joints, would carry me far beyond the purpose of the present paper. Suffice it to say, that my constitutional treatment consists in putting the system in the best possible condition to desire and assimilate food. For local application I use more than everything besides, the bichlorid. hydrarg. particularly in synovitis. I am in the habit of applying it every day or two; from the size of a nickel cent to that of a half dollar, producing an ulcer sufficiently deep to remain several days. In acute synovitis the application should be much more extensive.

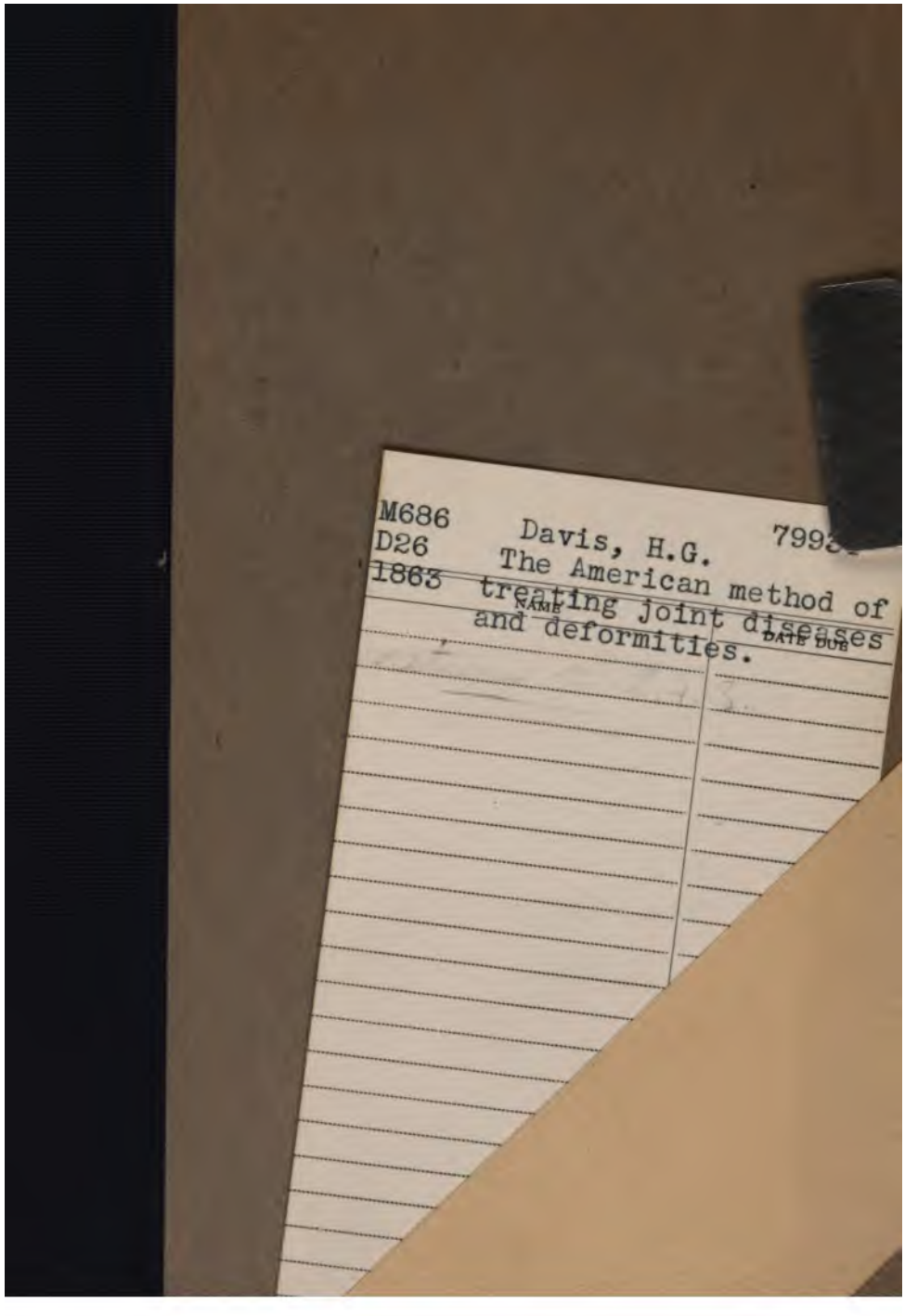
The earlier the treatment proposed in this paper is instituted in diseases of the joints, the more certain will be the recovery without disorganization; but through all the *stages*, the effort should be to retain the limb at its full length and normal position. Recovery cannot only more readily take place while in this position, but the limb will also be incomparably more useful, as well as ornamental.

In witnessing the remarkable and frequently unexpected results in recovery of motion from the persevering application of "con-

ision," one becomes more and more aware of
to be attached to the strange words of the
', *Tiphaisne*, that made so profound an impres-
an physician, *Scarpa*. Verily, they are words
written in letters of gold: "*Nature will not*
t only to a gradual force!"

Respectfully submitted,

HENRY G. DAVIS.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